



1. Description of Watershed Activity:

Water quality monitoring and sanitary surveys are important components of the Metropolitan District Commission/Division of Watershed Management (DWM) watershed protection program for the Massachusetts Water Resources Authority (MWRA)/MDC drinking water supply system. DWM has conducted water quality sampling and analysis in its reservoirs and the tributary streams for more than 75 years. The DWM has established water quality laboratory facilities at the Quabbin and Wachusett Reservoirs. Additional laboratory support is provided by the the MWRA at their Deer Island Laboratory. As part of the water quality monitoring program, DWM staff collect and analyze more than 3500 individual tributary and reservoir samples each year. Staff also conduct sanitary surveys within all watershed sub-basins on a 5-year cycle.

2. Goals of the Program:

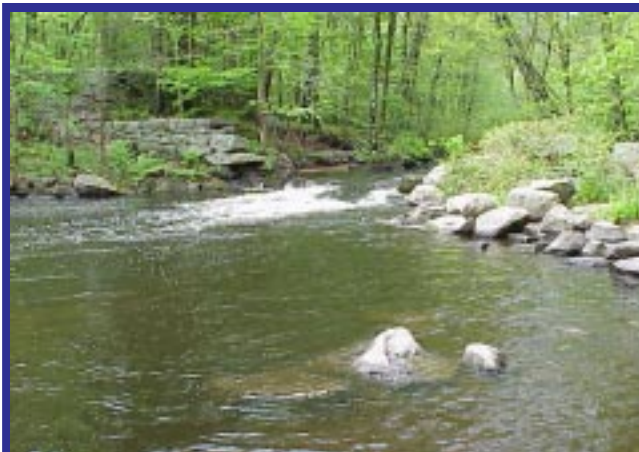
The goals of the DWM water quality monitoring program are:

- To continually assess the microbiological water quality of the public water supply source waters to protect public health.
- To assess the ecological health and vitality of the reservoir watershed related to operations and in response to system changes.
- To identify and correct existing or potential threats of water contamination or degradation of the reservoirs and tributaries within the watershed system.
- To ensure DWM compliance with applicable state and federal water quality criteria for public drinking water supply sources.

3. Method of Approach:

The DWM has established 59 primary, or routine, water sampling stations in the reservoirs and on major tributaries throughout the Quabbin Reservoir, Ware River, and Wachusett Reservoir watersheds. There are 29 sampling sites located on tributaries or small ponds in the Quabbin Reservoir and Ware River watersheds, and 20 sampling locations on tributaries in the Wachusett Reservoir watershed. There are 5 sites representing water withdrawn from Quabbin Reservoir, and 5 Wachusett Reservoir stations. DWM staff analyze water quality parameters that include: coliform bacteria, conductivity, temperature, dissolved oxygen, pH, turbidity, alkalinity, hardness, color, chlorides, nutrients, metals, algae, macroinvertebrates, and *Giardia* and *Cryptosporidium*. Sample information collected from these stations is entered into a database which is used to determine expected ranges of values at each station, as well as to look at long-term (i.e. several years) water quality trends in the watersheds.

Figure 1: Source Waters



The Quinapoxet River is a tributary to the Wachusett Reservoir. Throughout the Wachusett Reservoir, Ware River, and Quabbin Reservoir watersheds, the quality of the water in these rivers has an effect on the quality of the drinking water used by millions of people. Therefore, it is essential to monitor the quality of each of these source waters.

If sampling reveals water quality values outside the normally expected range, staff conduct follow-up sampling and field work to determine the reason for the anomaly. If a problem is found, staff write a field report documenting the source of contamination and actions are initiated to correct the problem. The network of primary stations provides an “early warning system” for most water quality impacts from land use changes or other activities which can degrade water quality.

Figure 2: Field Testing

The photographs at right show tributary water quality monitoring conducted at the Quinapoxet River in the Wachusett Reservoir Watershed. Field instruments provide instantaneous readings for temperature, dissolved oxygen, pH, and conductivity. Samples are also collected and brought back to the laboratory, where additional physical, chemical, and biological tests are conducted. If laboratory or field results are out of the range of normally observed values, follow-up testing and field inspections are conducted. If a source of pollution is found during the inspection, MDC works

with the landowner or other responsible party to see that corrective action is taken. Shown in the background are a water level staff gauge and the intake to a continuous read, U.S. Geological Service stream gauge.



4. Ongoing Monitoring Modifications:

Monitoring is modified to gain knowledge about a subbasin or to sample particular, short-term conditions or events. Regulatory requirements and priorities are constantly changing, and monitoring must also be modified to respond to these changes. Sampling programs are also modified as new and improved sampling and analysis methods evolve. In addition to primary (long-term) sampling sites, DWM has also established secondary stations which

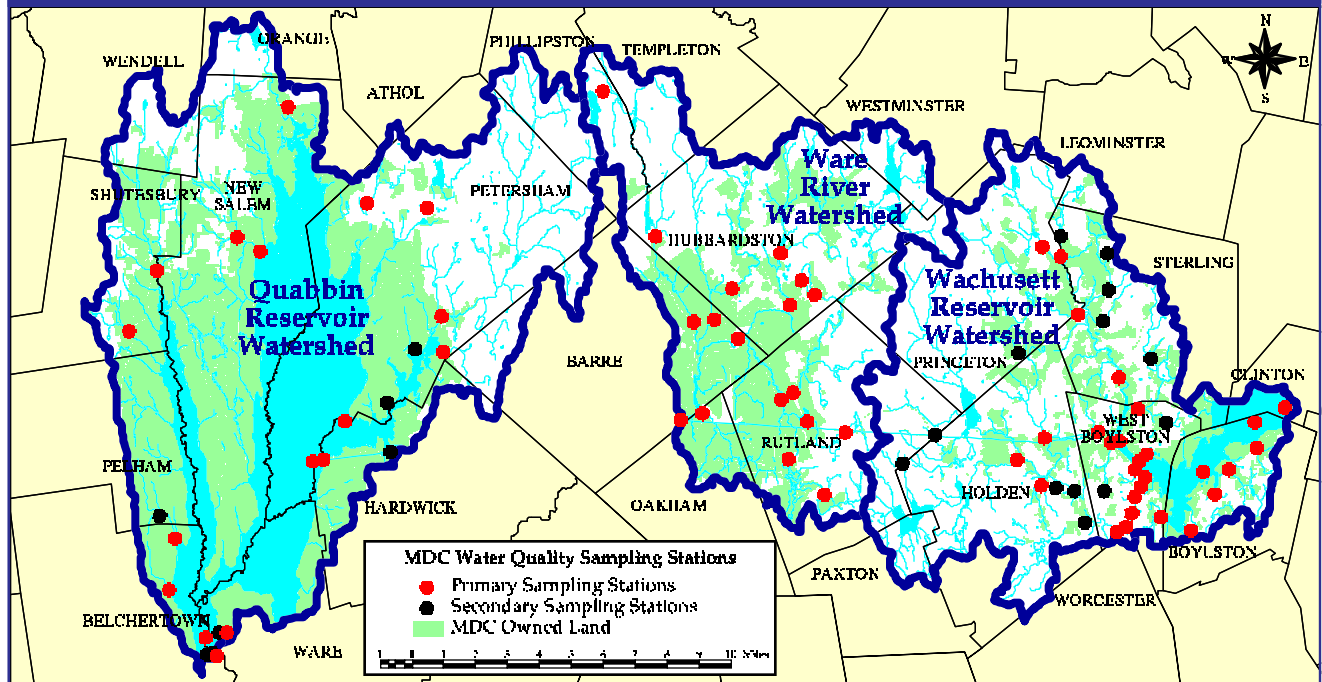
The photographs below show a water quality monitoring team at work on the Quabbin Reservoir. Water quality testing, similar to that described for tributaries (above) is also conducted on both reservoirs. At near left, an



MDC Environmental Analyst is deploying a water quality probe which monitors multiple chemical parameters and also determines water depth of the sample. Quabbin Reservoir has depths of up to 120 feet and Wachusett Reservoir has depths of up to 100 feet. Since water quality can vary greatly at different depths in the water column, it is important to accurately determine the depth from which reservoir samples are collected.

Figure 3: Test Locations

The map below shows the distribution of many of the water quality sampling locations throughout the MDC watershed system. Primary sampling stations, shown in red, are permanent sampling locations. Samples are collected on a regular basis every year. Current secondary stations, shown in black, are sampled for shorter periods of time to evaluate specific conditions, such as seasonal or climatic events.



are sampled for varying periods of time, to evaluate particular problems or as part of a specific study. The mix of primary and secondary stations results in a dynamic watershed water quality monitoring program. The primary stations allow evaluation of long-term trends, while the secondary stations allow flexibility in the program to meet short-term needs.

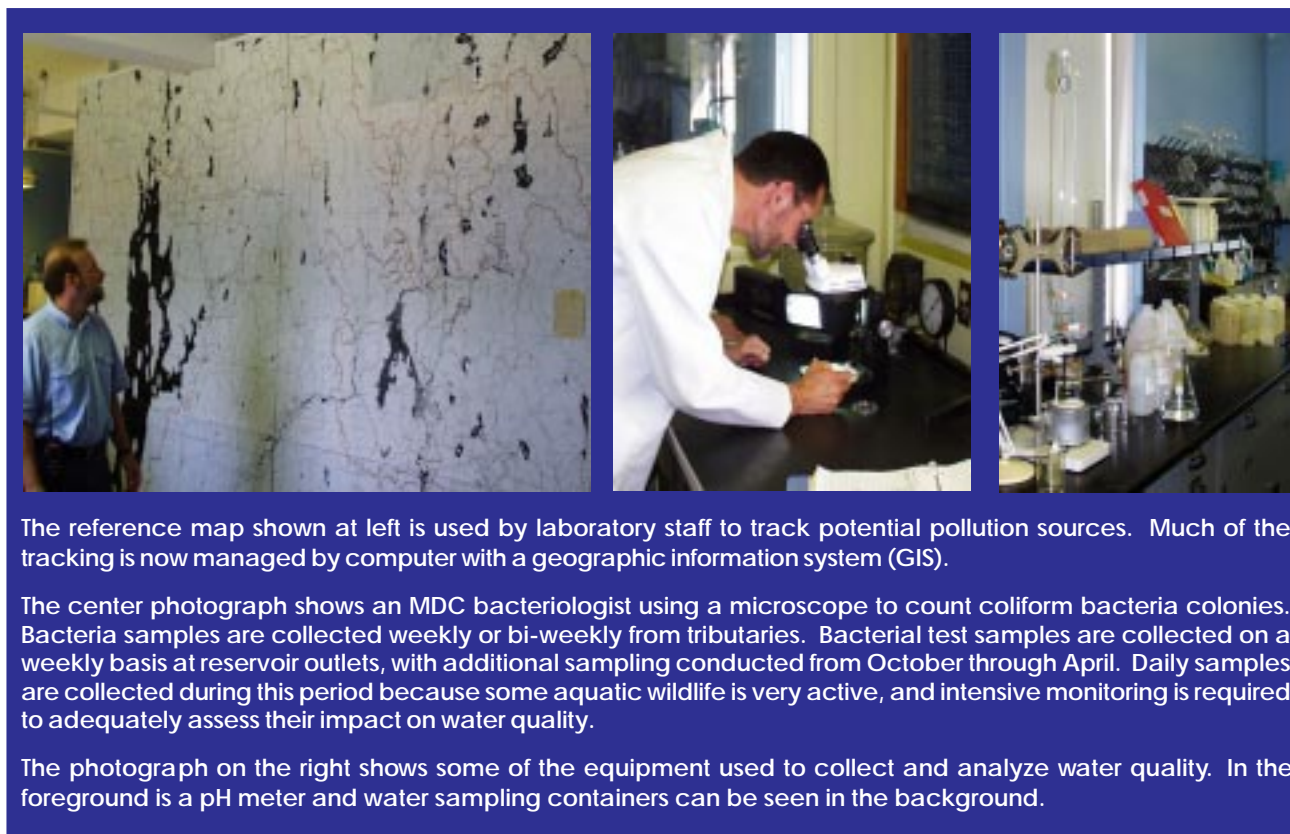
5. Water Quality Studies:

The DWM conducts numerous intensive water quality studies to investigate specific conditions in the watersheds. These studies include:

- Baseline studies documenting water quality conditions prior to construction of sew-

ers in Holden and West Boylston, including a multi-year study of neighborhoods particularly affected by septic system failures.

- Stormwater studies, including work to characterize stormwater quality associated with land use types.
- Gull impact studies including reservoir transect sampling to assess the effectiveness of the bird harassment program.
- Sampling to provide data to document pollution problems and support enforcement action, if needed.

Figure 4: Laboratory Testing


The reference map shown at left is used by laboratory staff to track potential pollution sources. Much of the tracking is now managed by computer with a geographic information system (GIS).

The center photograph shows an MDC bacteriologist using a microscope to count coliform bacteria colonies. Bacteria samples are collected weekly or bi-weekly from tributaries. Bacterial test samples are collected on a weekly basis at reservoir outlets, with additional sampling conducted from October through April. Daily samples are collected during this period because some aquatic wildlife is very active, and intensive monitoring is required to adequately assess their impact on water quality.

The photograph on the right shows some of the equipment used to collect and analyze water quality. In the foreground is a pH meter and water sampling containers can be seen in the background.

The focus of DWM's watershed protection program is to protect public health by controlling sources of pathogens in the watershed system. It is often difficult to relate elevated sources of "indicator bacteria" to the actual source of the pathogens, due to limitations of currently available testing methods. The DWM has initiated several projects to develop better laboratory methods of identifying the sources of pathogens in the watershed. The DWM is funding a cooperative research program with the University of Massachusetts, De-

partment of Civil and Environmental Engineering to develop and evaluate new and improved pathogen and viral laboratory detection methods. These methods include sero-typing and genetic marking of microbes to identify and quantify actual pathogen sources in water samples. These efforts are a reflection of the Division's commitment to placing the highest priority on public health protection.

DWM water quality data are published in annual reports, which are available from the MDC/DWM.

For More information (Reference Number FS99.03) Contact:

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